

# Innovation in the Biological Sciences

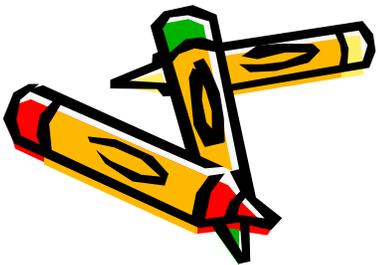
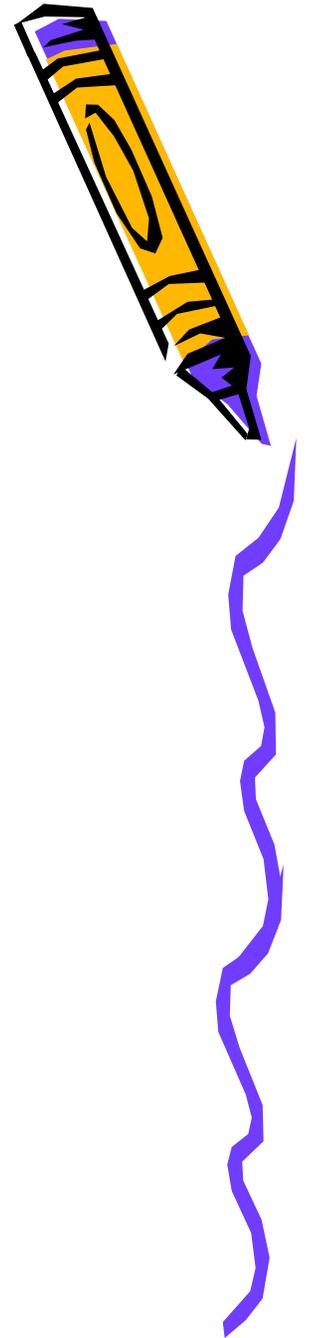
Exploring the Interfaces Between the  
Life and Physical Sciences



A Presentation to the BIO Advisory Committee  
April 30, 2009  
Joanne Tornow



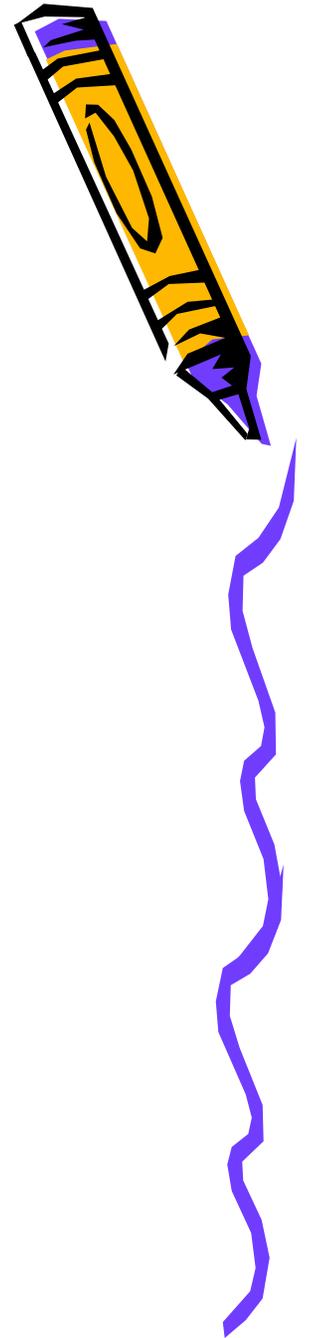
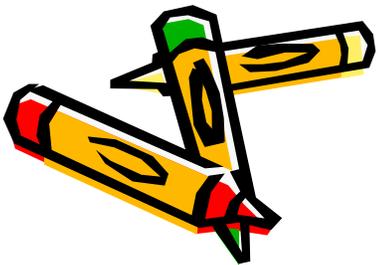
*"If you always do  
what you always did,  
you'll always get  
what you always got."*

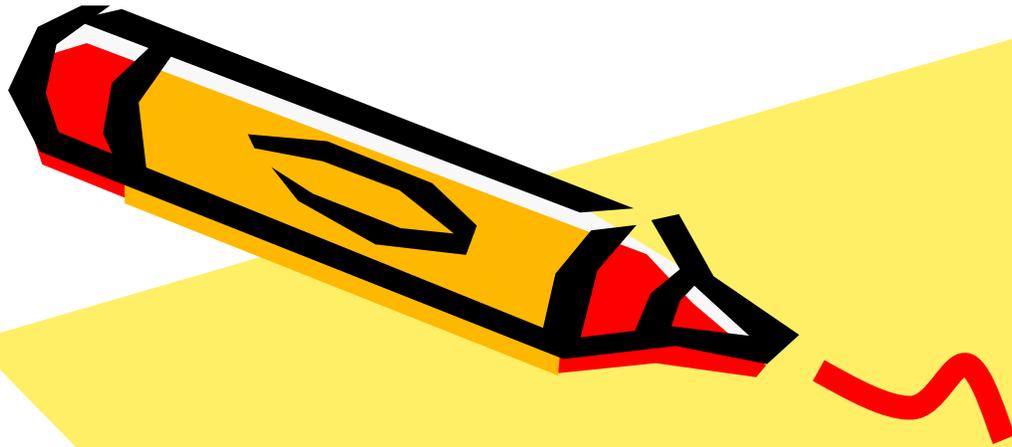




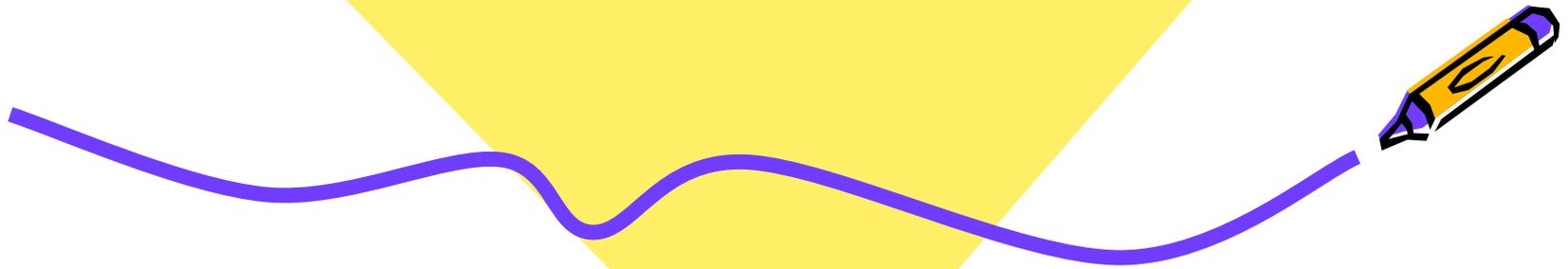
# Experiments in Innovation

- IDEAS Factory "Sandpit"
- Interdisciplinary review





IDEAS Factory  
"Sandpits"

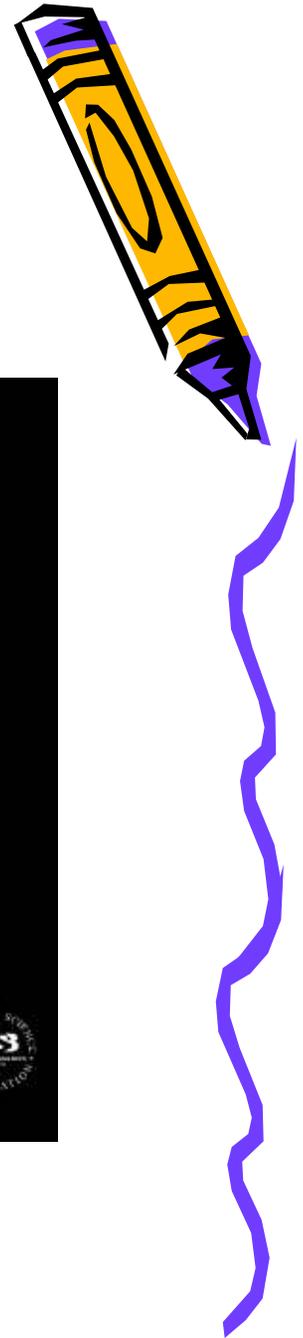
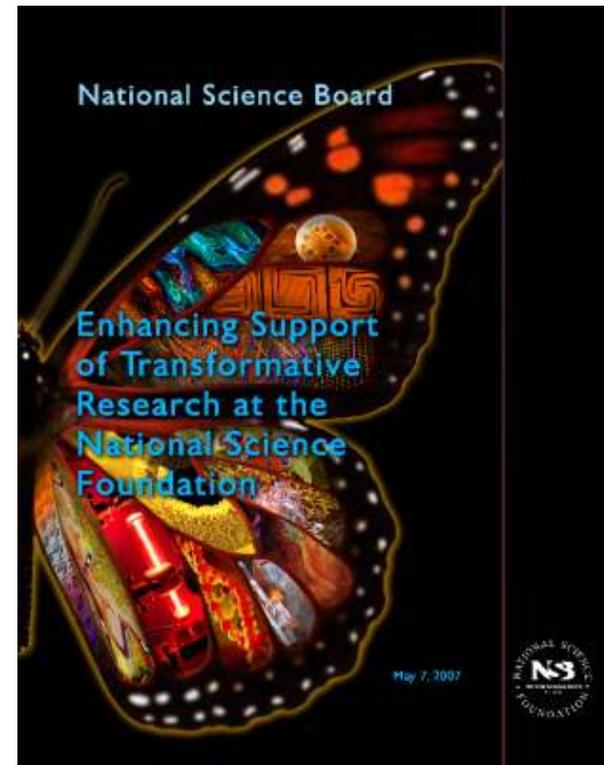
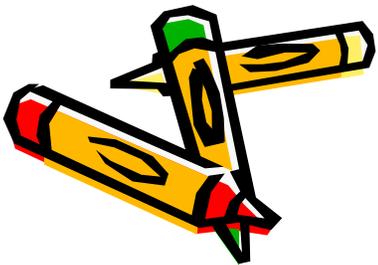




# How Did the Sandpit Idea Originate?

Summer 2007,  
EPSRC contacts NSF  
in response to NSB  
report

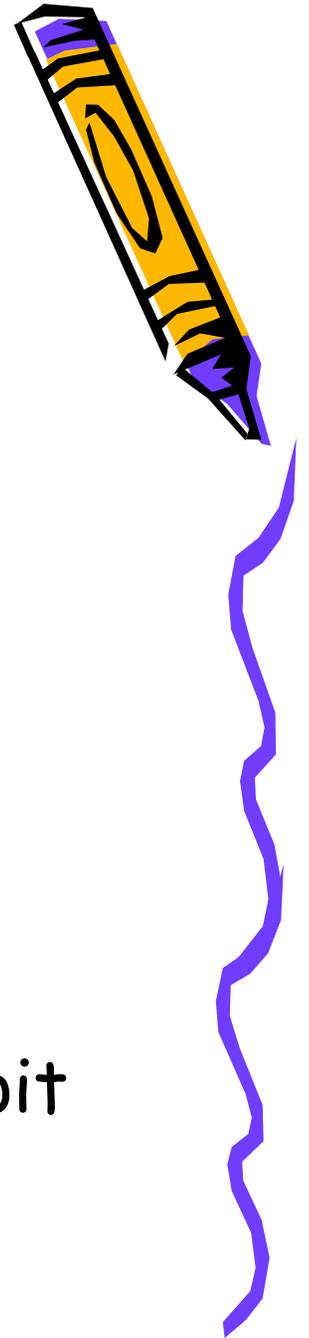
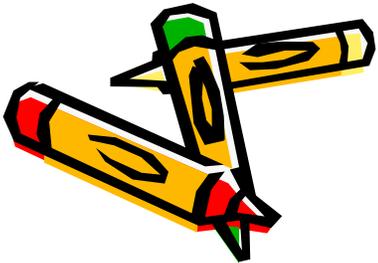
Begin dialog to share  
best practices





# The IDEAS Factory

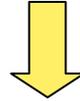
- Program initiated in 2004 by UK EPSRC to explore mechanisms of generating innovative, high-risk, research projects
- Central feature: "Sandpit"
  - Intensive, interactive, 5-day event
  - Funding for ideas generated at sandpit



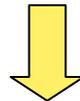


# Sandpit Concept

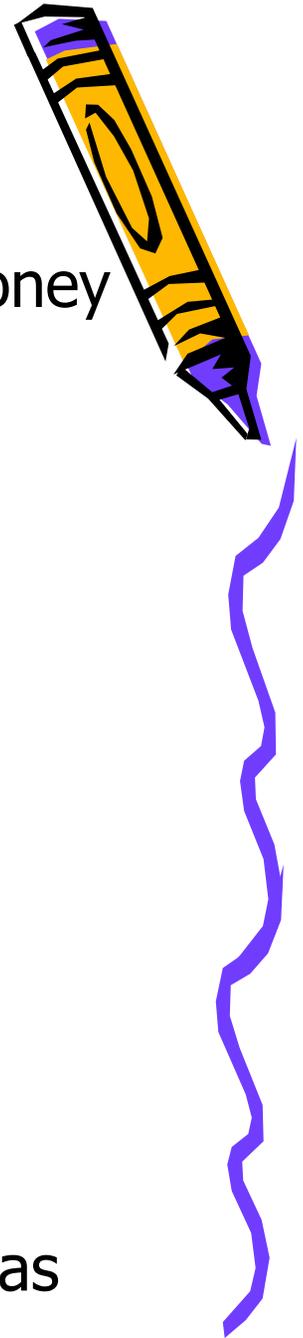
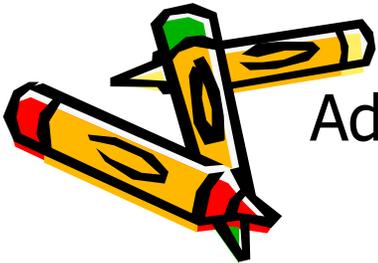
Inputs: Grand Challenge Topic, Creative People, Money



Creative Environment: "Sandpit"



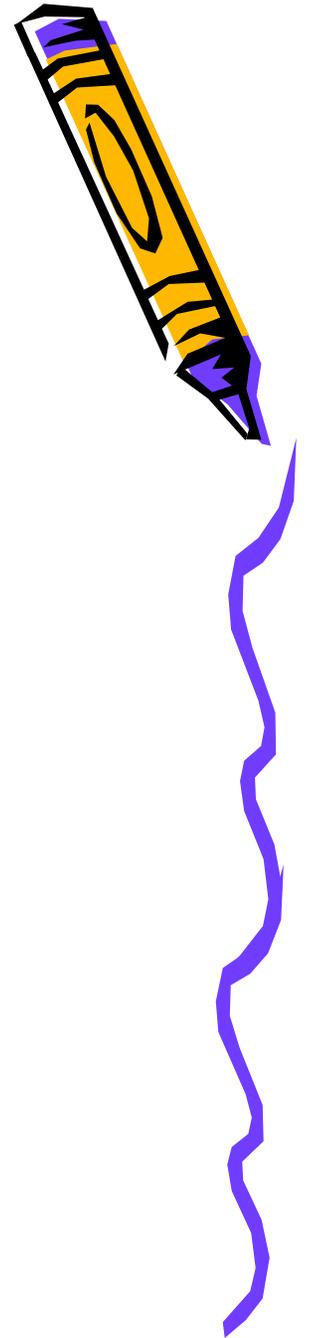
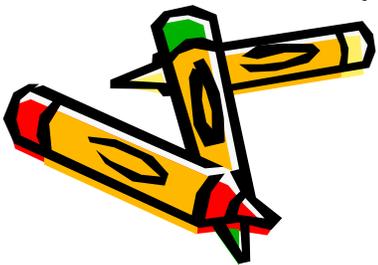
Outputs: Potentially Transformative, Novel,  
Adventurous, Innovative, Interdisciplinary Ideas  
"Wow Factor"





# Joint NSF-EPSCRC Sandpit

- Discussions begin in late April, 2008
- Topic: Synthetic Biology
- Memorandum of Agreement, signed November 2008
  - EPSCRC and NSF
    - BIO, ENG, MPS, SBE
    - OISE, Policy, OGC
    - NSF Deputy Director
    - State Department

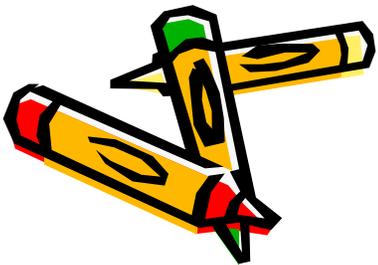




# Why Synthetic Biology?

Emerging interdisciplinary,  
international area of interest

- NSF activities:
  - \$18.5M Synthetic Biology Engineering Research Center
  - >\$12M (to date) for investigator-initiated projects
  - Highlighted in recent ENG and BIO activities
- UK activities:
  - £4.9M EPSRC Science and Innovation award, Imperial College
  - £900K BBSRC-EPSRC funding of 7 networks
  - EPSRC Responsive Mode Signpost
  - BBSRC Highlight Notice

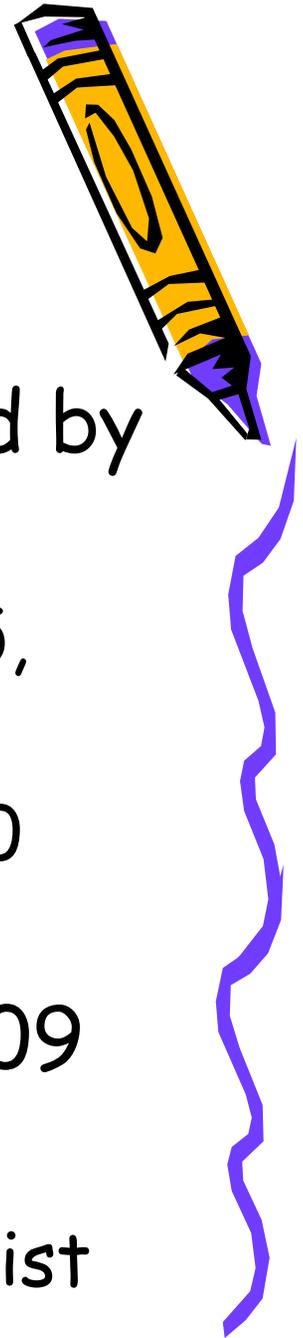


Building a world-class synthetic  
biology research community

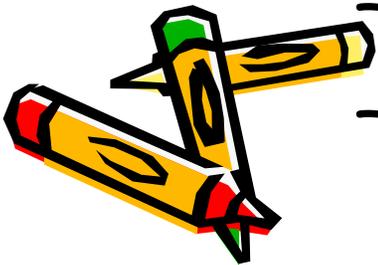




# Participant Selection Process



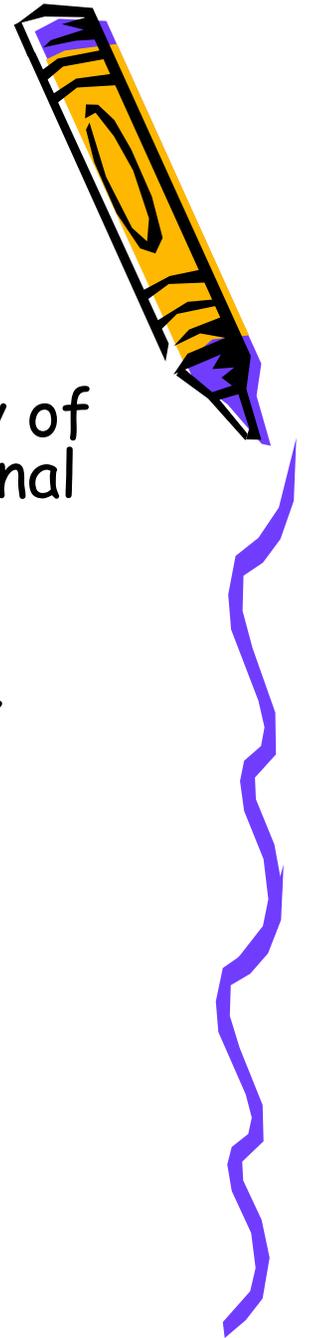
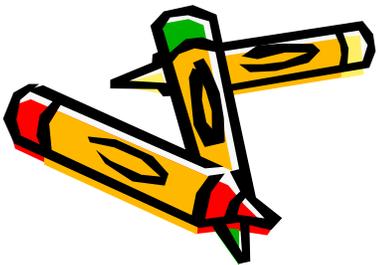
- Open call for participants issued by EPSRC in November 2008
  - 2-page application, due January 15, 2009
  - ~170 applications received, ~50:50 US:UK
- Selection panel, January 27, 2009
  - Panel of "Mentors"
  - Advised by occupational psychologist





# Joint NSF-EP SRC Sandpit

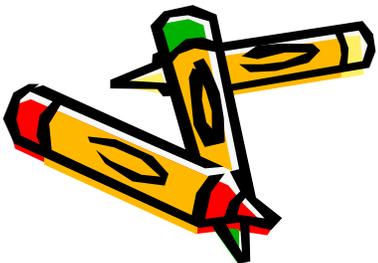
- 30 participants chosen (14 UK, 16 US), variety of disciplines, diverse backgrounds, mix of personal attributes
- Sandpit held March 30-April 3, 2009 at Airlie Conference Center, Warrenton VA
- £3M EP SRC
- \$5M NSF

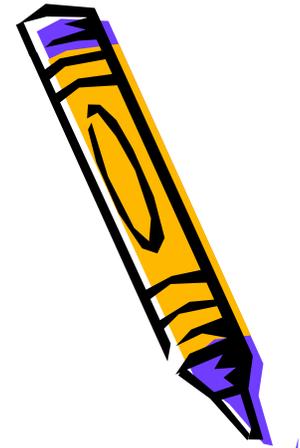
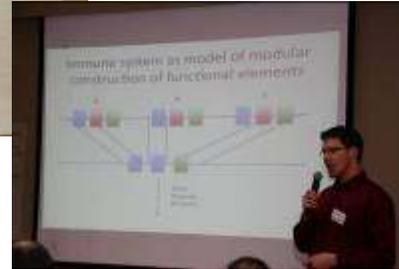
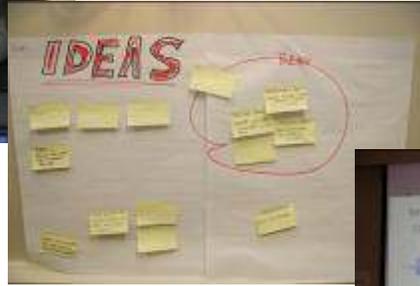




# Who is Involved?

- Director and Mentors
  - focus on the topic
- Facilitators
  - focus on the process
- Participants





**Interact**

**Clarify**

**Ideate**

**Develop**

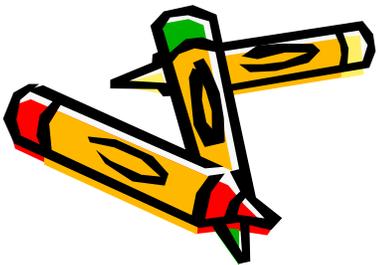
**Implement**

**Five day residential sandpit**

**2 months**

**Real time peer review**

**Select project ideas**







# CONCERNS

Handwritten notes on a board under the heading "CONCERNS":

- LEARN NEW SKILLS
- NO KARAOKE SUNDAY!
- THAT WE STAY STUCK IN THE ROOM
- NOISE
- THAT I WOULDN'T WANT TO LIVE IN A BOAT
- THAT WE HAVE TO BUILD A RAFT
- THAT WE HURT OFF SOMEONES EYES
- THAT WE HURT OFF SOMEONES EARS
- THAT WE HURT OFF SOMEONES NOSE
- THAT WE HURT OFF SOMEONES MOUTH
- THAT WE HURT OFF SOMEONES HAIR
- THAT WE HURT OFF SOMEONES SKIN
- THAT WE HURT OFF SOMEONES BONES
- THAT WE HURT OFF SOMEONES LIVER
- THAT WE HURT OFF SOMEONES LUNGS
- THAT WE HURT OFF SOMEONES STOMACH
- THAT WE HURT OFF SOMEONES PANCREAS
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- THAT WE HURT OFF SOMEONES ANUS
- THAT WE HURT OFF SOMEONES RECTUM
- THAT WE HURT OFF SOMEONES COLON
- THAT WE HURT OFF SOMEONES SILOPHAGE
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# EXPECTATIONS

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**CHRIS VOIGT**

- Developing the sensors, circuits, and actuators to program cells and the theory to understand how to put them together. the application of these tools to problems in energy, agriculture, and materials.
- E. coli, yeast, mammalian cells
- UCSF

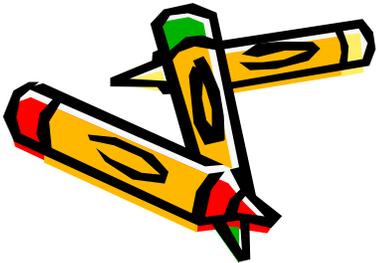
**SKILLS & INTERESTS**

- Exploration & Travel
- Camping, hiking, fishing
- Wine (brought some)
- Advanced problems in child rearing

**CONTACT ME**



*Antiqua*



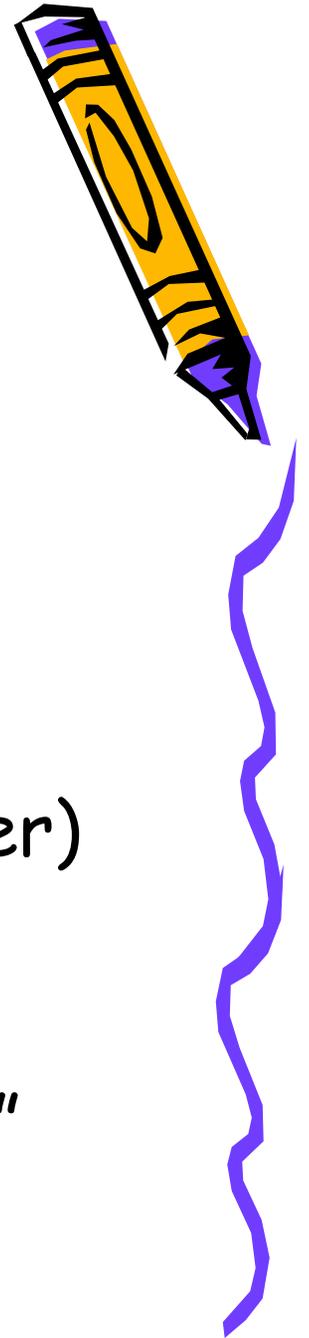
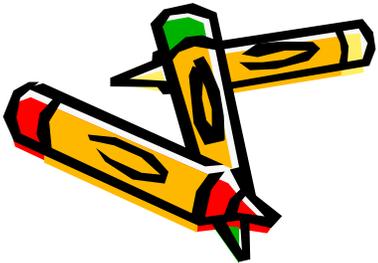


# Day Two: Defining the Challenges

- Speakers
  - Hiroaki Kitano (Sony)
  - Marianne Talbot (Oxford)
  - Carl Pilcher (NASA)
  - Dave Rejeski (Woodrow Wilson Center)

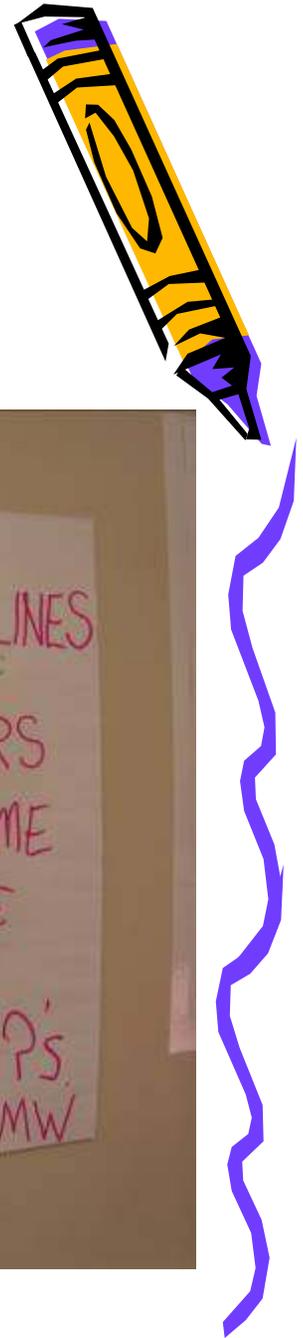
"Wouldn't it be nice if..."

"What keeps me awake at night is..."

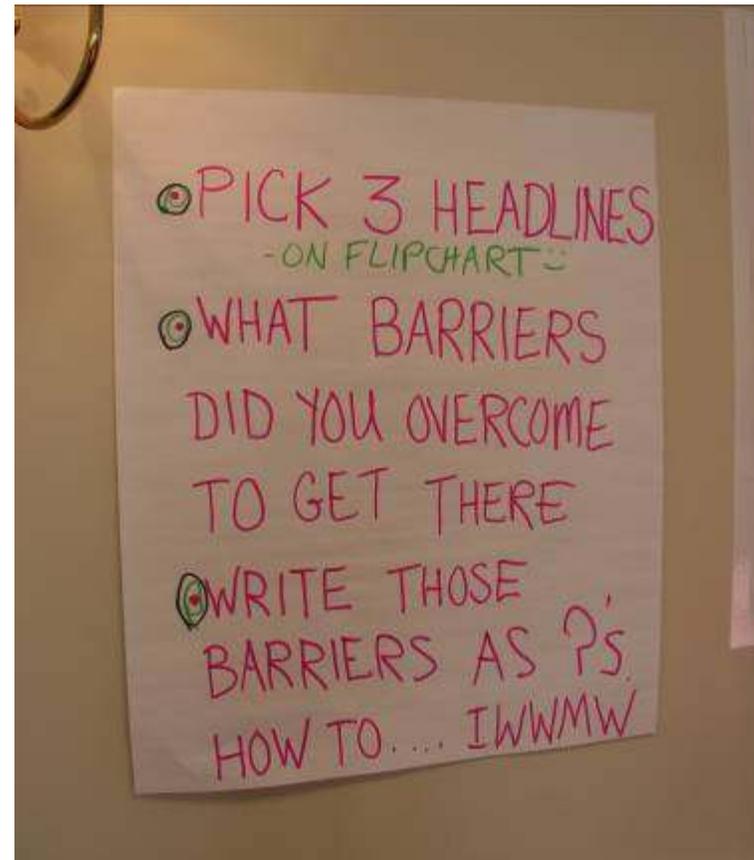
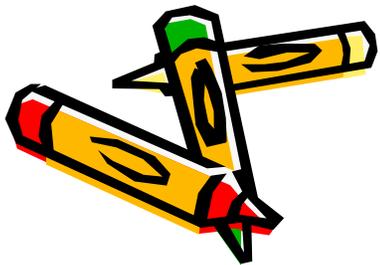




# Day Two: Defining the Challenges



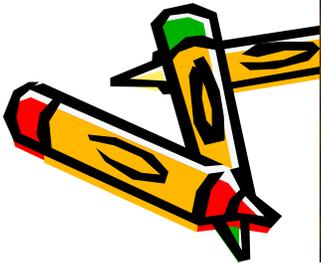
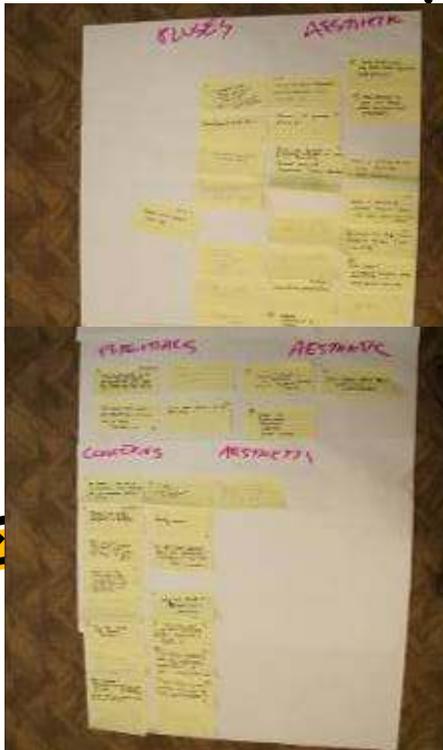
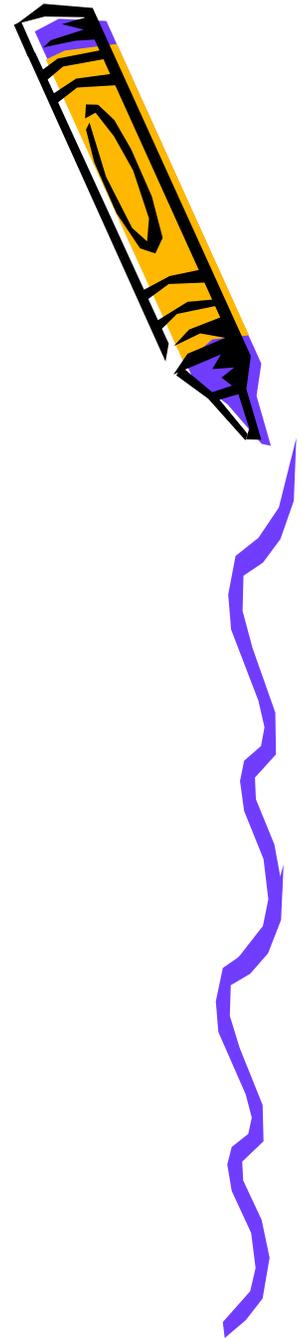
- Think 5-10 years forward
- Where do we want to be?
- What do we need to do to get there?





# Days Three and Four: Develop and Refine Ideas

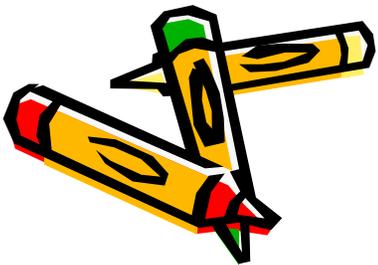
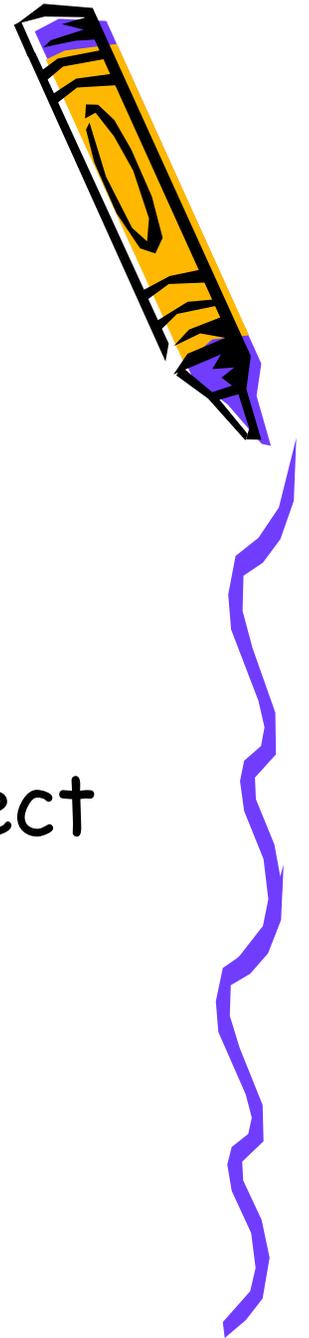
Iterative rounds of  
5 minute presentations,  
followed by post-it peer review





## Day Five: Conclusion

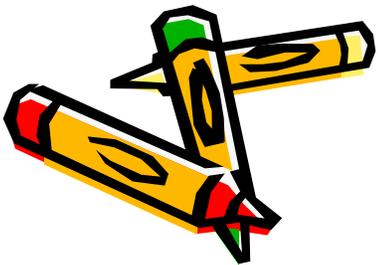
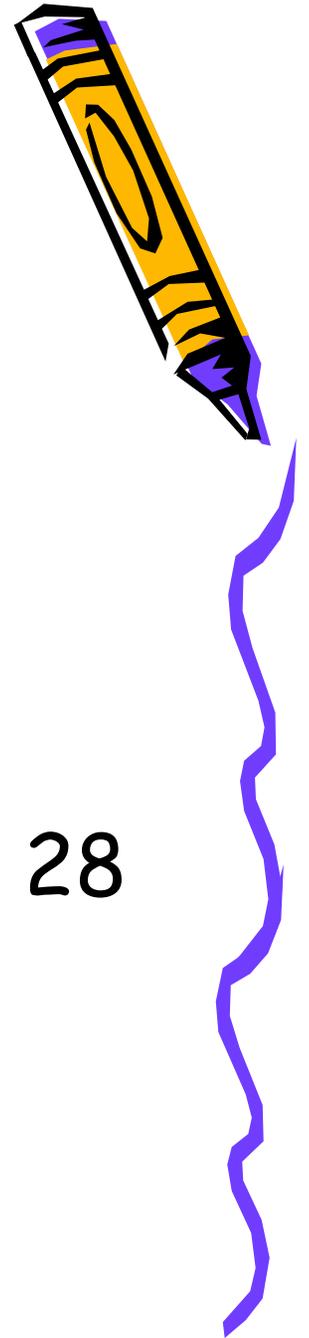
- Ten project ideas presented
- Final round of peer review
- Mentors deliberated
- Funding agencies invited five project ideas back as full proposals





# What Happens Next?

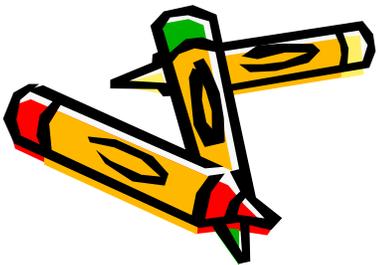
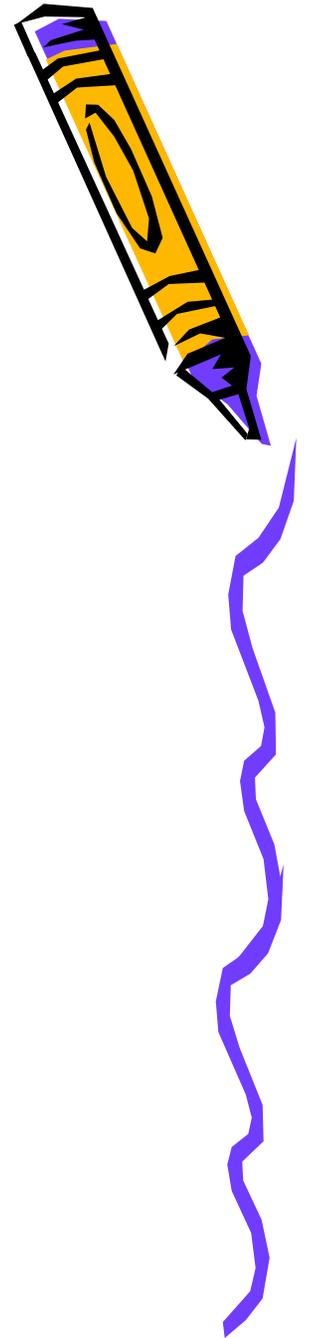
- Groups will submit draft of full proposals by May 14 to EPSRC and NSF for verification check
- Final proposals to be submitted in parallel to NSF and EPSRC by May 28
- Agencies process awards





# Looking Ahead

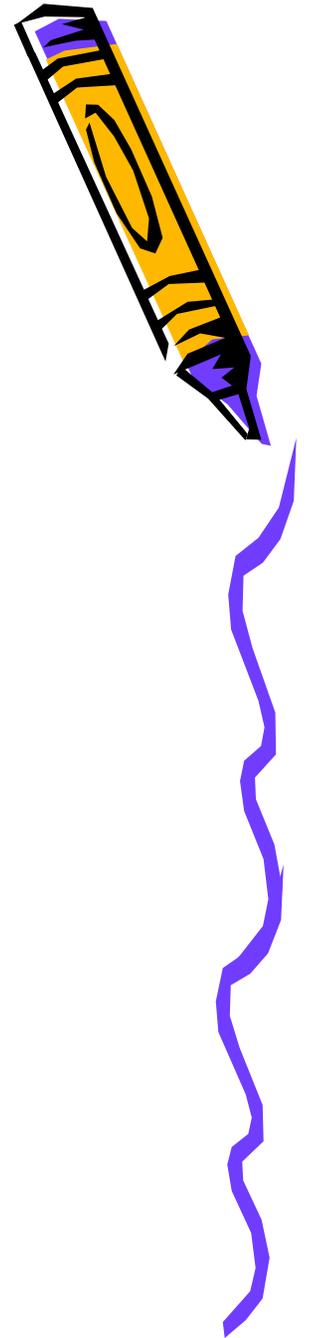
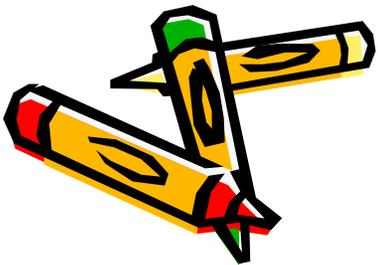
- Oversight to strengthen collaborations, build network
- PI meeting at mid-point (in ~18 months) to share progress

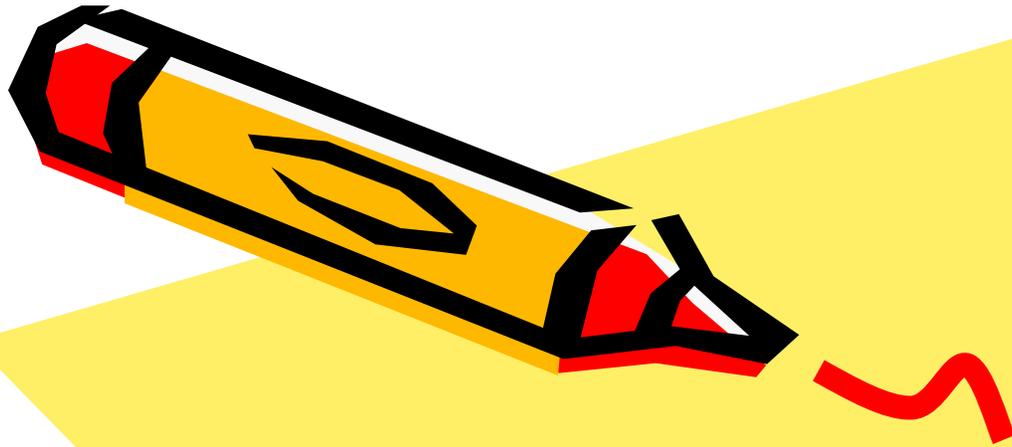




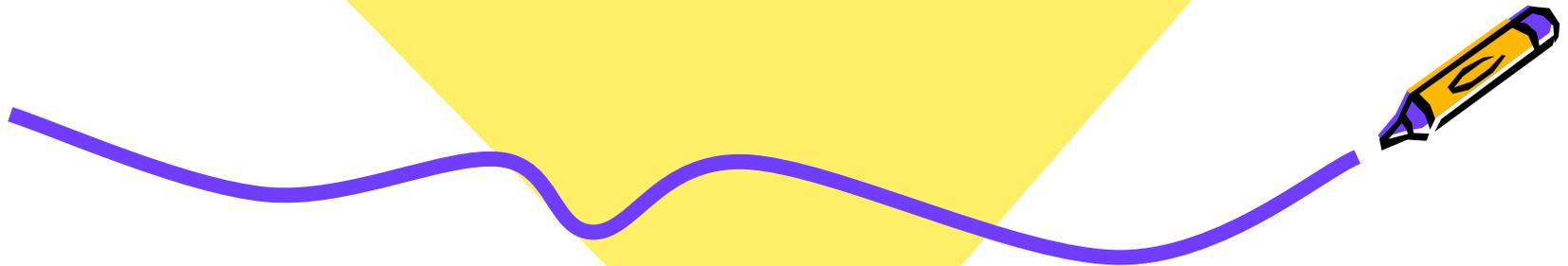
# Assessment

- Process
  - Incorporated creativity training
  - Accelerated idea development
- Science
  - High risk, potentially high impact
  - Too early to assess
- When to use this approach?





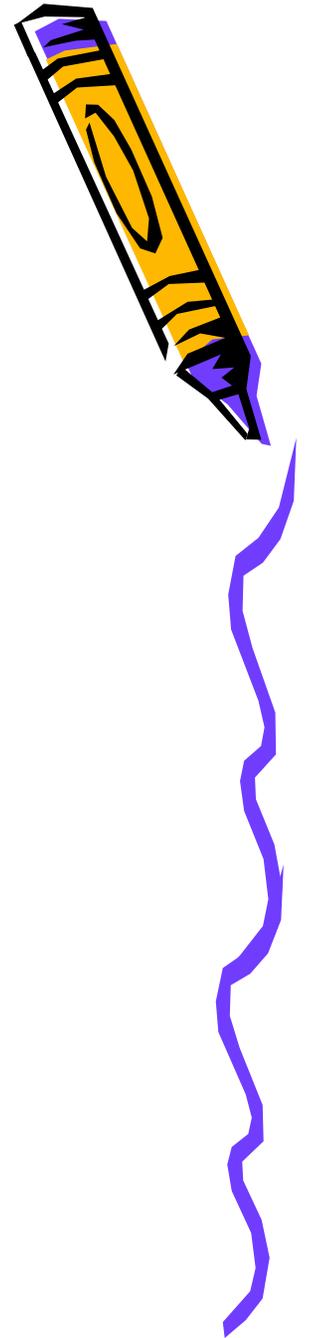
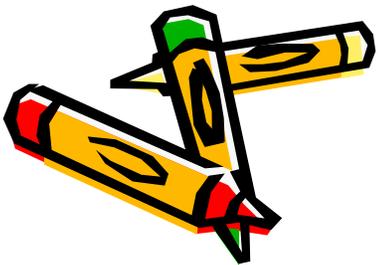
# Interdisciplinary Review





# Models

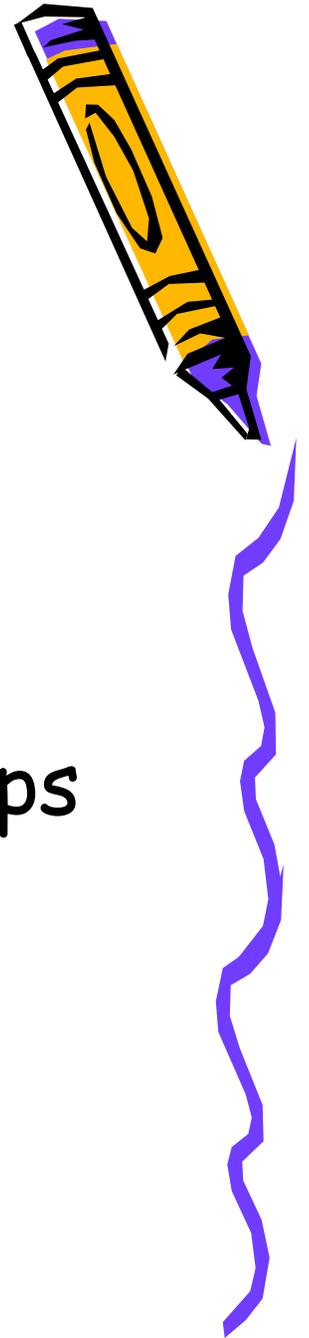
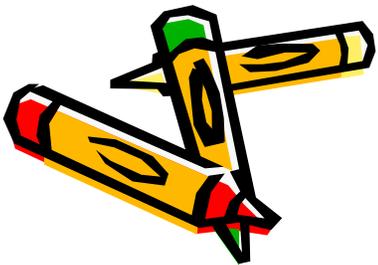
- Ad hoc Co-Review
- Paired PDs
- Shared PD





# Ad hoc Co-Review

- Individual or small number of proposals
- PI and/or PD initiated
- Can be facilitated by working groups
  - E.g., BIO-CISE working group

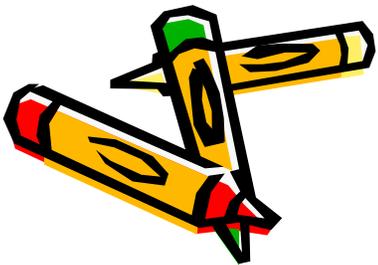
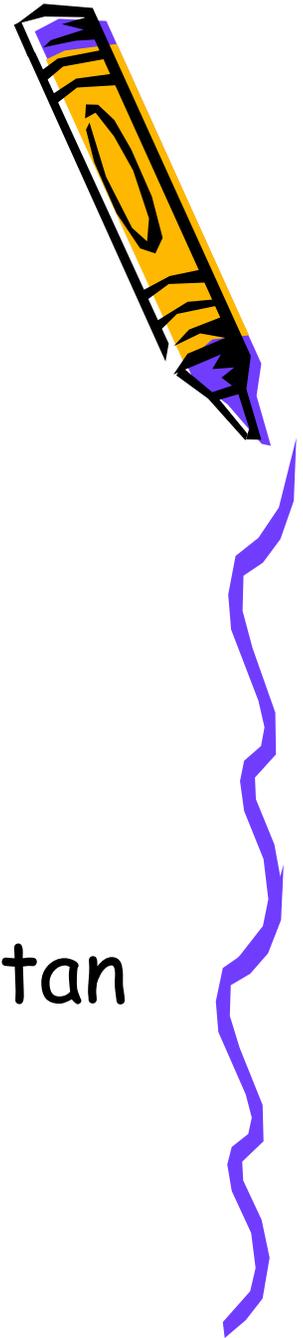




# Paired PDs

## Exploring the MCB-MPS Interface

- Initiated in 2003
- CAREER proposals of interest to MCB and at least one MPS division reviewed at one interdisciplinary panel each Fall for six years
- Kamal Shukla (BIO/MCB) and Krastan Blagoev (MPS/PHY)

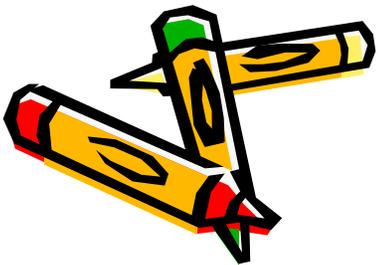
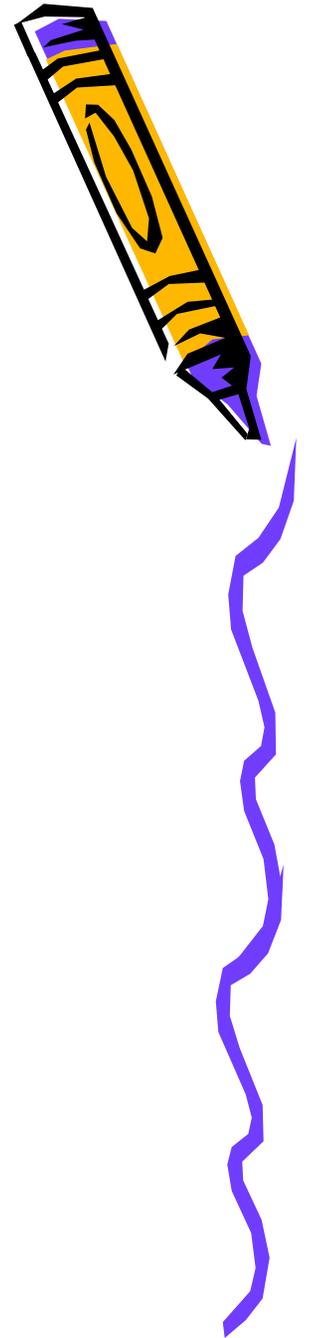




## Shared PD

### Exploring the MCB-CHE interface

- Wilfredo Colón, shared 50:50 between MCB and CHE
- Began January 2008
- Has held two MCB-CHE panels for proposals at the interface





# Outcomes

- All models build bridges
- Ad hoc interactions highly flexible
- Shared and paired PDs interactions:
  - May be more sustainable
  - Has improved communication between divisions
  - Redefined boundaries
- Shared PD becomes intimately knowledgeable about two divisions, but has extra administrative burden
- Paired PDs retain division identity, but serve as effective conduit between divisions

